PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant:	TRAVIS A. LEMKE	**Examiner:**	
Serial No.:	09/876,459	**Group Art Unit:**	1723
Filed:	June 7, 2001	**Docket No.**	54197-237098
For:	CONDUCTIVITY FEEDBACK CONTROL SYSTEM FOR SLURRY BLENDING		

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Commissioner for Patents
Washington, D.C. 20231

I CERTIFY THAT, ON SEPTEMBER 19, 2001, THIS PAPER IS BEING SENT VIA FIRST CLASS MAIL TO THE ASSISTANT COMMISSIONER FOR PATENTS, WASHINGTON, D.C. 20231.

Kimberly L. Bzdok

PRELIMINARY AMENDMENT

Please enter this Preliminary Amendment in the cited application.

Please amend the application as follows:

IN THE SPECIFICATION

Please replace the paragraph beginning at page 6, line 17, with the following rewritten paragraph:

-- Figures 7A and 7B are a flow diagram of chemical blending program executed by the control system shown in Figure 6; --

Please replace the following four paragraphs, beginning at page 18, line 28, with the following rewritten paragraphs:

-- More specifically, Figures 7A and 7B show a flow diagram of one preferred methodology 700 of the present invention in which conductivity data is used as a feedback control to accurately provide a blended slurry having a solids content between the Upper and Lower Qualification Range Setpoints.

Thus, as shown at step 702, microprocessor 602 begins the mixing process by opening valve 412 to fill mix vessel 402 with a desired amount of diluent, as detected by liquid level sensor 434. Once mix vessel 402 has been filled to a level detectable by

liquid level sensor 434, liquid level sensor 434 generates a signal that is transmitted to microprocessor 602. Control system 436 would, in turn, generate a control signal which causes valve 412 to close. Pump 432 is then actuated to continually recirculate the diluent through mix vessel 402 and recirculation line 428, as shown at step 704. Before initiating subsequent steps of the mixing method shown in Figure 7A, pump 432 is allowed to recirculate the blended slurry (or initially, only the diluent) for a predetermined length of time to thoroughly mix the diluent and concentrated slurry and generate a homogeneous blended slurry.

After the mixing operation at step 704, the conductivity of the blended slurry within mix vessel 402 and recirculation line 428 is monitored by conductivity assembly 414. This monitoring activity is shown at step 706. The measured conductivity is then compared to the setpoints including the Desired Qualification Setpoint, Upper and Lower Qualification Range Setpoints, and the Coarse and Fine Blend Setpoints. This comparison is indicated by step 708 in Figure 7A.

If the comparison performed at step 708 indicates that the blended slurry conductivity is less than the Coarse Blend Setpoint (step 710) (e.g., at the beginning of the mix cycle), microprocessor 602 either opens valve 416, or keeps valve 416 open, to continue to add concentrated slurry to recirculation line 428. This step is shown at 712 in Figure 7A and results in the mixture of the added concentrated slurry with the blended slurry within the recirculation line 428. Steps 704-712 are then continuously repeated as shown in Figure 7A until the measured conductivity of the blended slurry reaches the Coarse Blend Setpoint. The continuous injection of concentrated slurry in this manner will cause the conductivity of the blended slurry to relatively quickly increase to the value represented by the Coarse Blend Setpoint.

After the comparison performed at step 710 indicates that the conductivity of the blended slurry has increased to a value which is greater than or equal to the Coarse Blend Setpoint, but less than or equal to the Fine Blend Setpoint (step 714), microprocessor 602 closes valve 416. Microprocessor 602 then calculates the length of time that valve 416 should be opened to add enough concentrated slurry to recirculation line 428 to increase the blended slurry conductivity to the Fine Blend Setpoint. These steps are shown generally at 716 and 718 in Figure 7A. In particular, at step 716 microprocessor 602 computes the difference between the Fine Blend Setpoint and the most recent measurement of the blended slurry conductivity at step

706. This difference is then multiplied by the Concentrated Slurry Injection Constant to compute the length of time that valve 416 should be opened. As shown at step 718, microprocessor 602 then opens valve 416 for the computed concentrated slurry injection time in an attempt to increase the conductivity of the blended slurry to the Fine Blend Setpoint. Upon the completion of step 718, steps 704-710 and 714-718 are repeated until the Fine Blend Setpoint is reached or exceeded (Step 720). --

Please replace the paragraph beginning at page 20, line 15, with the following rewritten paragraph:

If the comparison performed at step 722 indicates that the blended slurry conductivity is still less than the Lower Qualification Range Setpoint, microprocessor 602 will calculate the length of time that valve 416 should be opened to inject or add enough concentrated slurry to recirculation line 428 to increase the blended slurry conductivity to the Desired Qualification Setpoint. These steps are shown generally at 734 and 736 in Figure 7B. In particular, at step 734 microprocessor 602 computes the difference between the Desired Qualification Setpoint and the most recent measurement of the blended slurry conductivity at step 706. This difference is then multiplied by the Concentrated Slurry Injection Constant to compute the length of time that valve 416 should be opened. As shown at step 736, microprocessor 602 then opens valve 416 for the computed concentrated slurry inject time to increase the conductivity of the blended slurry to the Desired Qualification Setpoint. Upon completion of step 736, the blended slurry is recirculated and mixed for a predetermined length of time (step 738), and steps 722 and 734-740 are repeated until the blended slurry has a conductivity within the qualification range window.

REMARKS

This Preliminary Amendment conforms the specification to correspond to substituted drawings that were submitted in response to a request to filed corrected application papers mailed August 8, 2001. In the substitute drawings, informal Figure 7 was separated into two figures, Figure 7A and Figure 7B. This Preliminary Amendment conforms the specification with Figures 7A and 7B. No new matter is added to the application by this amendment.

Attached hereto is a marked-up version of the changes made to the specifications by the current amendment. The attached pages are captioned "**Version with markings to show changes made**."

No fee is believed to be necessary. Should any fee be required, the Commissioner is authorized to charge our Deposit Account No. 06-0029 and is requested to notify us of the same.

Respectfully Submitted,

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By: ______________________

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Figure 1 is a flow diagram of a representative process capable of producing a slurry having a solids content within a qualification range in accordance with the present invention;

Figure 2A is a graphical depiction of the relationship between conductivity and time as monitored during the preparation of a two component slurry produced according to the representative process of Figure 1;

Figure 2B is a graphical depiction of the relationship between conductivity and time as monitored during the preparation of a four component slurry produced according to the representative process of Figure 1;

Figure 3 is a graphical depiction of a conductivity/solids content calibration curve;

Figure 4 is a diagram of a representative chemical mixing system capable of producing a slurry having a solids content within a qualification range in accordance with the present invention;

Figure 5 is a partial cross-sectional view of a preferred conductivity probe suitable for use in the systems of Figures 4, 8 and 9;

Figure 6 is a block diagram of a programmable logic control (PLC) system for operating the chemical mixing systems shown in Figures 4, 8 and 9 in accordance with the present invention;

~~Figure 7 is~~ Figures 7A and 7B are a flow diagram of a chemical blending program executed by the control system shown in Figure 6;

Figure 8 is a diagram of a second representative chemical mixing system capable of producing a slurry having a solids content within a qualification range in accordance with the present invention;

Figure 9 is a diagram of a third representative chemical mixing system capable of producing a slurry having a solids content within a qualification range in accordance with the present invention.

Detailed Description of the Preferred Embodiments

The embodiments of the present invention described below are not intended to be exhaustive or to limit the invention to the precise forms disclosed in the following detailed

Blended slurry from system 400 is delivered to a point of use (not shown) through discharge line 430. In the embodiment shown, discharge line 430 is coupled to recirculation line 428 at a point between pump 432 and mix vessel 402. Valve 444 is used to control the discharge of blended slurry through line 430.

More specifically, ~~Figure 7 shows~~ Figures 7A and 7B show a flow diagram of one preferred methodology 700 of the present invention in which conductivity data is used as a feedback control to accurately provide a blended slurry having a solids content between the Upper and Lower Qualification Range Setpoints. Thus, as shown at step 702, microprocessor 602 begins the mixing process by opening valve 412 to fill mix vessel 402 with a desired amount of diluent, as detected by liquid level sensor 434. Once mix vessel 402 has been filled to a level detectable by liquid level sensor 434, liquid level sensor 434 generates a signal that is transmitted to microprocessor 602. Control system 436 would, in turn, generate a control signal which causes valve 412 to close. Pump 432 is then actuated to continually recirculate the diluent through mix vessel 402 and recirculation line 428, as shown at step 704. Before initiating subsequent steps of the mixing method shown in Figure ~~7~~ 7A, pump 432 is allowed to recirculate the blended slurry (or initially, only the diluent) for a predetermined length of time to thoroughly mix the diluent and concentrated slurry and generate a homogeneous blended slurry.

After the mixing operation at step 704, the conductivity of the blended slurry within mix vessel 402 and recirculation line 428 is monitored by conductivity assembly 414. This monitoring activity is shown at step 706. The measured conductivity is then compared to the setpoints including the Desired Qualification Setpoint, Upper and Lower Qualification Range Setpoints, and the Coarse and Fine Blend Setpoints. This comparison is indicated by step 708 in Figure 7A ~~7~~.

If the comparison performed at step 708 indicates that the blended slurry conductivity is less than the Coarse Blend Setpoint (step 710) (e.g., at the beginning of the mix cycle), microprocessor 602 either opens valve 416, or keeps valve 416 open, to continue to add concentrated slurry to recirculation line 428. This step is shown at 712 in Figure ~~7~~ 7A and results in the mixture of the added concentrated slurry with the blended slurry within the recirculation line 428. Steps 704-712 are then continuously repeated as shown in Figure ~~7~~ 7A until the measured

conductivity of the blended slurry reaches the Coarse Blend Setpoint. The continuous injection of concentrated slurry in this manner will cause the conductivity of the blended slurry to relatively quickly increase to the value represented by the Coarse Blend Setpoint.

After the comparison performed at step 710 indicates that the conductivity of the blended slurry has increased to a value which is greater than or equal to the Coarse Blend Setpoint, but less than or equal to the Fine Blend Setpoint (step 714), microprocessor 602 closes valve 416. Microprocessor 602 then calculates the length of time that valve 416 should be opened to add enough concentrated slurry to recirculation line 428 to increase the blended slurry conductivity to the Fine Blend Setpoint. These steps are shown generally at 716 and 718 in Figure ~~7~~ <u>7A</u>. In particular, at step 716 microprocessor 602 computes the difference between the Fine Blend Setpoint and the most recent measurement of the blended slurry conductivity at step 706. This difference is then multiplied by the Concentrated Slurry Injection Constant to compute the length of time that valve 416 should be opened. As shown at step 718, microprocessor 602 then opens valve 416 for the computed concentrated slurry injection time in an attempt to increase the conductivity of the blended slurry to the Fine Blend Setpoint. Upon the completion of step 718, steps 704-710 and 714-718 are repeated until the Fine Blend Setpoint is reached or exceeded (Step 720).

If the comparison performed at step 722 indicates that the conductivity is within the qualification range window (e.g., greater than or equal to the Lower Qualification Range Setpoint but less than or equal to the Upper Qualification Range Setpoint), the mixing process is complete and the batch of blended slurry is qualified for subsequent use as indicated by step 724.

If the comparison performed at step 722 indicates that the blended slurry conductivity is still less than the Lower Qualification Range Setpoint, microprocessor 602 will calculate the length of time that valve 416 should be opened to inject or add enough concentrated slurry to recirculation line 428 to increase the blended slurry conductivity to the Desired Qualification Setpoint. These steps are shown generally at 734 and 736 in Figure ~~7~~ <u>7B</u>. In particular, at step 734 microprocessor 602 computes the difference between the Desired Qualification Setpoint and the most recent measurement of the blended slurry conductivity at step 706. This difference is then multiplied by the Concentrated Slurry Injection Constant to compute the length